will be put to an experimental test. If found correct, the suggestion will offer itself that a causal relationship may possibly exist between the *little* steps taken under selection, and the longer one appearing as a mutation.

The variation described in this paper made America on a collecting expedition. My associate, Mr. C. C. Little, was then in charge its appearance during my absence in South of the experiments. He at once recognized the importance of the variation from a theoretical standpoint and has given especial care to its preservation. For this I wish both to thank and to congratulate him. A less discriminating observer might easily have mistaken this animal for an albino with soiled fur.

W. E. Castle

Laboratory of Genetics,
Bussey Institution,
Forest Hills, Mass.,
February 8, 1912

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE SECTION B—PHYSICS

The annual meeting of Section B of the American Association for the Advancement of Science was held with the American Physical Society at the Bureau of Standards, Washington, December 27–30, 1911. Four forenoon sessions and three afternoon sessions were held. Of these, two were "general interest" sessions in charge of the officers of Section B and five were occupied with research papers, in charge of the American Physical Society. In all seventy-four papers were presented and one symposium held. Eight papers were presented by title only.

The presiding officers were Professor R. A. Millikan, vice-president of Section B, and Professor W. F. Magie, president of the Physical Society. At a short business session of the section Professor Theodore Lyman was elected to represent the section on the council, Professor C. E. Mendenhall a member of the sectional committee (for five years) and Professor F. A. Saunders a member of the general committee.

All sessions were held in a large laboratory of the Bureau of Standards. The attendance at several was about two hundred and for most others exceeded one hundred. It was probably the largest and most representative gathering of physicists ever held in America. In each of the three days when two sessions were held the scientific staff of the bureau generously provided a fine lunch for all in attendance.

The address of the retiring president of the association was of special interest to physicists this year. It was given on Wednesday evening in the assembly hall of the new National Museum by Professor A. A. Michelson on the subject "Recent Progress in Spectroscopic Methods."

On Friday evening a subscription dinner was given by the Philosophical Society of Washington in honor of Section B and the American Physical Society at the Shoreham Hotel. This was attended by about one hundred and was a most delightful occasion. Dr. E. B. Rosa, the retiring vice-president, acted as toastmaster and Professor A. A. Michelson, the retiring president of the association, was among the guests of honor.

Among the members of the association who were elected fellows by action of the council at this meeting are the following members of Section B: H. A. Wilson, Frank Wenner, Fay C. Brown, E. A. Harrington and W. J. Fisher.

The officers for the next annual meeting, to be held in Cleveland during the convocation week of 1912–13, are as follows:

Vice-president and Chairman of Section B—Professor A. G. Webster, Clark University.

Retiring Vice-president—Professor Robert A. Millikan, University of Chicago.

Secretary—Dr. W. J. Humphreys, U. S. Weather Bureau, Washington.

Member of Council—Professor Theodore Lyman, Harvard University.

Sectional Committee—R. A. Millikan, A. G. Webster, W. J. Humphreys, A. P. Carman, G. F. Hull, E. L. Nichols, A. Zeleny, C. E. Mendenhall and the president and secretary of the American Physical Society.

The two general-interest sessions in charge of Section B were held on Thursday, December 28. At the morning session Professor W. F. Magie, of Princeton, delivered the presidential address of the American Physical Society on "The Primary Concepts of Physics." This is given in full in the February 23 issue of Science. The remainder of the morning session was devoted to a symposium on "The Ether," led by Professor A. A. Michelson. Professors A. G. Webster, E. W. Morley, W. S. Franklin, D. F. Comstock and G. N. Lewis took part in the discussion. The significance and place of the principle of relativity was of course given principal attention and some difficulty was

experienced in finding common ground upon which to stand. At the afternoon session of the same day the retiring chairman of Section B gave his vice-presidential address upon "The Work of the Electrical Division of the Bureau of Standards." This is printed in full in the January 5 number of SCIENCE. Then followed an address by Professor H. A. Wilson, on "The Structure of the Atom," and by Director S. W. Stratton, on "The Work of the Bureau of Standards."

The following are abstracts of these addresses:

The Structure of Atoms: Professor H. A. WILSON, McGill University.

The essential constituent of matter appears to be electricity; recent researches, experimental and theoretical, suggest that electricity is in fact the only constituent of matter.

Free negative electrons can be obtained from almost any form of matter by heating, by the action of ultra-violet light or in other ways. The optical properties of matter are now explained by the presence of negative electrons; the Zeeman effect and dispersion may be specially mentioned. Many of the electrical and thermal properties of metals have been satisfactorily explained by supposing that metals contain negative electrons which move about inside them like the molecules of a gas.

Negative electrons must therefore be regarded as a universal constituent of all forms of matter. These electrons, moreover, are with good reason believed to be simply minute particles of negative electricity of much less than atomic size.

Electrically neutral matter must contain as much positive electricity as negative; it is clear, therefore, that all matter must also contain positive electricity. One of the most important results of recent electrical researches is the fact that while free negative electrons can be easily obtained from any kind of matter, positive electricity is always associated with at least one atom and never appears in the form of positive electrons. Positively charged molecules seem to be in all cases the result of the removal of negative electrons from neutral molecules. Since it appears that all negative electricity is made up of equal particles and since it is very probable that any atom can be exactly neutral it follows that the amount of positive electricity in any atom must be an exact multiple of the charge of one negative electron. This makes it probable that positive electricity is also made up of equal parts, but so far they have not been obtained free.

The absence of effects due to the earth's motion relative to the ether can be explained on the electromagnetic theory if it is supposed that this theory covers all phenomena. This appears to be a strong argument in favor of the purely electrical nature of matter.

It will be convenient now to mention the chief electrical theories of atomic structure which have been proposed.

According to Sir J. J. Thomson, atoms consist of solid spheres of positive electricity inside which negative electrons move about freely. If the sphere is taken to be of uniform density then a negative electron is attracted towards the center with a force proportional to its distance from the center. The electrons of course repel each other. The electrons will distribute themselves uniformly throughout the sphere so as to neutralize it as completely as possible and can vibrate about their positions of equilibrium. According to Sir J. Larmor, atoms consist of a number of positive and negative electrons describing orbits about each other. There may be rings of electrons revolving round concentric rings. On this view an atom is a sort of small gaseous nebula without any sort of solid foundation.

A third theory recently adopted by Rutherford regards the atom as containing a nucleus of positive electricity with negative electrons outside it; probably describing orbits around it. On this view the atom is a sort of minute solar system. The positive nucleus will always require the same number of negative electrons to keep it neutral so that it provides a definite foundation fixing the identity of the atom. The same may be said of the sphere in Sir J. J. Thomson's theory.

I shall now proceed to very briefly review some of the evidence as to the nature of atoms that can be derived from different branches of physics and to consider how far the theories mentioned are consistent with it.

The most important property of atoms is their extraordinary stability in presence of each other. For example, the atoms in a compound molecule are very intimately associated and yet they preserve their identity even at the highest temperatures. The molecules in a gas are continually colliding violently with other molecules, yet the atoms are not destroyed. Negative electrons can be knocked out of atoms by the impact of rapidly moving particles such as the cathode rays and α rays, yet the atoms retain their identity and after regaining negative electrons are unaffected. Facts like these appear to be decisive against Sir J. Larmor's theory. On this theory we should expect

all mixtures of different substances to rapidly change into the same substance. There is in fact nothing in Sir J. Larmor's theory to account for the stability of atoms which according to any such theory would be broken up by collisions and could not preserve their identity in compound molecules. This theory fails to explain why free positive electrons can not be obtained while negative electrons are easily isolated. On the other two theories the stability of the atoms can be ascribed to the stability of the positive sphere or nucleus. When negative electrons are knocked out of the atom the excess of positive charge can only be neutralized by an equal number being replaced, which restores the atom to its original condition. Important evidence as to the nature of atoms is provided by the properties of gases interpreted according to the kinetic theory. The viscosity, rate of diffusion and other properties of gases seem to be best explained if the molecules are regarded as having a definite volume of radius about 10^{-8} cm. This is usually termed the radius of molecular action and two molecules which are separated by a distance greater than about 10^{-8} cm. can be regarded as having no appreciable action on each other. Similar conclusions can be derived from the theory of surface tension and many other phenomena. The energy necessary to remove a negative electron from an atom, for example, indicates that the positive and negative charges are about 10^{-8} cm. apart in the atom.

The most important evidence from the kinetic theory is derived from the ratio of the specific heat at constant pressure to that at constant volume. This ratio γ is equal, according to the theory, to $1 + 2/n$ where n is the number of degrees of freedom per molecule. For helium, neon, argon, krypton, xenon, mercury vapor and other gases $\gamma = 1.66$, which requires that $n = 3$. This means that when such gases are heated all the energy goes into the three degrees of freedom of translational motion of the molecules, so that the molecules acquire no energy of rotation or vibration. To explain this it appears necessary to suppose that the molecules behave like rigid smooth spheres. Such gases are therefore believed to be monatomic, each atom behaving like a smooth sphere. These gases, however, give spectra containing many lines so that it is certain that their atoms contain electrons which can vibrate. It is necessary to suppose that collisions between these atoms do not set their electrons in vibration, which seems to require the electrons to be protected in some way. This seems to be strongly in favor of Sir J. J. Thomson's theory and against the other two theories, for if the electrons were describing orbits outside it is hard to see how they could escape violent disturbance during a collision.

Gases like nitrogen, hydrogen and carbonmonoxide have $\gamma = 1.4$, which gives $n = 5$. This means that their molecules behave like smooth rigid solids of revolution. These gases are diatomic, so that it appears that the two atoms in the molecule are firmly fixed together. This can be explained on Sir J. J. Thomson's theory by supposing that the two positive spheres stick together and it can not be explained on the other two theories.

The theory of the constitution of chemical compounds seems to require the atoms in compound molecules to be firmly fixed together in definite relative positions. The numerous cases of stereoisomerism and optically active isomers seem conclusive as to this. Similar conclusions follow from the properties of crystals which can be explained in many cases by supposing the atoms combined in a definite way throughout the crystal so that the whole crystal is, so to speak, one large molecule.[1] The rigidity of many crystals requires the atoms to be firmly fixed together.

On Sir J. J. Thomson's theory two atoms can stick together if one or more electrons are transferred from one to the other. In this case they would attract each other with great force and we may suppose the positive spheres to be flattened up against each other by the pressure so as to form a rigid combination.

Sir J. Larmor's theory and Rutherford's planetary theory are difficult to reconcile with the idea that atoms become firmly fixed together in compounds and rigid solids. On such theories we should expect to have nothing but gases and liquids and only very simple compounds.

Another important property of solids is their impenetrability by gases. This seems to require the atoms to occupy nearly the whole volume. The compressibility of solids is not great and does not diminish much at low temperatures. If atoms were made up merely of electrons of very minute volume we should expect solids at very low temperatures to contract to a very small volume or at any rate to become easily compressible. This again is in favor of atoms with a definite volume of radius about 10^{-8} cm. as on Sir J. J. Thomson's theory. This argument is taken from the Faraday lecture for 1911 by Professor Richards, who puts

[1] See A. E. H. Tutton, "Crystallography," London, 1911.

forward many good reasons for the view that atoms have a definite volume and are compressible.

The number of negative electrons in atoms can be deduced from observations on the scattering of the β rays of radium or of Röntgen rays and in other ways, as Sir J. J. Thomson has shown. The results obtained indicate that the number is a small constant multiple of the atomic weight.

The scattering of α rays led Rutherford to adopt the idea of a positive nucleus, since some α rays are turned through a larger angle than can be explained by the electric forces due to a charge equal to that on one electron. It may be, however, that other forces besides ordinary electric force act on α rays when moving through matter. The α rays are helium atoms which have a radius about 10^{-8} cm., so that they probably only get through by displacing the atoms of the matter. If we suppose the positive sphere of one atom can not penetrate into that of another then the scattering of α rays by matter can probably be explained on Sir J. J. Thomson's theory.

The most interesting application of Sir J. J. Thomson's theory is the explanation which it affords of the relation between the atoms in series of similar elements like fluorine, chlorine, bromine, iodine. Sir J. J. Thomson supposes that the negative electrons in the sphere are arranged in concentric spherical layers and that each element in a series of similar elements is derived from the one before it by the addition of one more layer. The writer[2] has worked out this idea and shown that it is in approximate agreement with the atomic weights and that the number of electrons per atom can be deduced approximately from the atomic weights. The result obtained was that the number of electrons is about eight times the atomic weight.

Probably the most promising of the many ways of obtaining evidence as to the structure of atoms is by the study of the spectra of the light which they give out when set vibrating by different disturbing agencies. Most spectra, however, are so complicated that very little progress has yet been made. The fact that spectra contain lines of definite wave length suggests that the electrons in the atom vibrate about positions of equilibrium or else are moving in magnetic fields of constant strength. This seems to be a strong argument against theories of the planetary type, for on such theories the period of vibration is not fixed, but depends on the radius of the orbit.

Any theory which explains spectra ought also to explain the Zeemann effect.

[2] *Phil. Mag.*, June, 1911.

An important question is whether all the lines in the spectrum of an element can be emitted by each atom or whether the different lines are emitted by different systems. The second view now seems the more probable. On this view the different lines do not correspond to the different possible modes of vibration of each atom, but each line is due to the vibration of a different system. Of course a particular system may give more than one line in some cases. Thus we might suppose a regular series of n lines to be due to the vibrations of molecules with one, two, three up to n atoms in the molecule. Other series for the same element might be due to molecules which had each lost say m electrons with up to n atoms per molecule. On this view the frequency of vibration would be a function of two integers n and m. The different series in the spectra of the alkalies can be represented approximately as functions of two integers, as is well known.

The only theories of series spectra which have been developed to any extent are due to Ritz ("Gesammelte Werke W. Ritz," Paris, 1911). In his earlier papers he supposed the lines in each series to be due to different modes of vibration of an elastic membrane having special properties. Later he abandoned this view and supposed each line due to a different system.

Ritz's atomic vibrator consists of an electron vibrating in the magnetic field of a bar magnet at a point along its axis. The electron is supposed to stay close to a particular point on the axis and to vibrate in the plane perpendicular to the axis. The distance from the electron to the nearest pole is taken to vary by equal increments and the distance between the two poles also is supposed to vary by equal increments in going from one atom to another. This makes the frequency a function of two integers and the function found agrees approximately with the observed frequencies. However, to obtain exact agreement Ritz had to suppose the increments to be not always exactly equal. Ritz supposed the bar magnet to be made up of a row of nearly equal elementary magnets. In any atom some of the elementary magnets are in the row and the rest may be supposed arranged so as to neutralize each other.

This idea of elementary magnets receives some support from recent work on the magnetic properties of bodies by Weiss and others. The elementary magnets of course may consist of electrons moving round orbits.

It now seems probable that the formulæ proposed for the representation of series spectra are not quite exact and are consequently to be regarded as merely empirical and so without much real physical significance. Almost any function of integers containing four or five arbitrary constants will represent with accuracy a series of values which vary in a regular way.

Ritz's theory seems to the writer to be very artificial and altogether improbable.

In conclusion we may say that while we are still far from arriving at a complete theory of atomic structure yet some progress has been made in that direction. It is easy to get a theory which will explain any particular set of facts, but the same theory will not explain all the different sets of facts.

As to the bearing of radioactivity on this question reference may be made to a paper by J. W. Nicholson in the *Philosophical Magazine* for December, 1911. The serious objections to planetary theories pointed out above apply to his suggestions.

The Work of the Bureau of Standards: Dr. S. W. STRATTON, Director.

For purposes of administration, the Bureau of Standards is for the present divided into seven divisions. The first four are based somewhat upon the usual divisions of the subject of physics, the work consisting primarily in the solution of problems relating to standards of measurement, precision measuring instruments, methods of measurement and the determination of constants. They also investigate the properties of materials when the determination of such properties involves the services and equipment of the physicist rather than those of the engineer. The fifth division includes the principal chemical work of the bureau. The sixth division, having to do principally with engineering tests and investigations not ordinarily included in the four physical divisions, is scarcely organized as yet, except in certain lines of testing. The seventh division, the newest and largest in the bureau, relates to the investigation and testing of engineering, structural and miscellaneous materials. The various divisions are subdivided into sections, based upon the natural classification of their work, and sometimes upon the lines along which the experts specialize. The bureau is perhaps unique in bringing together the physicist, the chemist and the engineering investigator into closer relationship than at any other scientific institution in the country. Every effort is made to promote cooperation, even at the expense of organization if need be.

The act establishing the Bureau of Standards authorizes it to take up, in addition to the usual problems in connection with the physical units and standards, the determination of physical constants and the properties of materials, that is to say, Congress in enacting this law recognized the necessity for standard values of constants and standards of quality as well as standards of measurement. Uniform and accurate values of physical constants are as essential in scientific investigation, engineering work or commerce and trade as are uniform and reliable standards of length or mass. Similarly, well determined and defined properties of materials are equally important in the design of structures, the operation of machinery and the various mechanical uses of materials. A knowledge of materials is necessary for their most efficient and economical use. The problems awaiting solution in connection with the properties of materials are almost infinite in number; hence, the bureau's work in this direction will be confined for some time to come to those investigations which are necessary for the production of standard values or authoritative data.

Attention should be directed to certain phases of the bureau's work, which are of great importance and which might be called the "by-products" of the bureau. These are, furnishing to the public information acquired by the bureau in the exercise of its functions; the giving of information to the other bureaus and institutions of the government concerning physical, chemical and engineering questions involved in their work, and the giving of information to state and municipal governments and especially to public service commissions, which are becoming a very important factor in state legislation. The experts of the bureau are consulted in regard to scientific principles involved in the enactment of legislation and the establishment of regulations. At this time the bureau has in press several publications intended primarily for the assistance of state and municipal governments and public service commissions. Another important "by-product" is the influence that the bureau is exerting upon the development of scientific methods and the establishment of research laboratories in connection with our industries. The efforts of the bureau in connection with the work of these laboratories and in undertaking its own technical researches will always be directed toward basing such investigations on sound scientific principles, and to assist those industries in a wider and more efficient use of the scientific discoveries. Finally, through the efforts

and influence of the bureau it has been largely instrumental in bringing into closer cooperation the different national bureaus with a view to international agreement as to the fundamental questions involved in matters pertaining to standards.

The following seventy research papers were presented at the sessions of Wednesday, Friday and Saturday, in charge of the officers of the American Physical Society. Most of them will be published, either in abstract or in full, in the *Physical Review*.

"An Important Practical Problem in Gyrostatic Action," W. S. Franklin, Lehigh University.

"A Relation between the Magnetic Hysteresis and the Tensile Strength of a Series of Iron-carbon Alloys," C. W. Waggoner, West Virginia University. (Read by title.)

"Relation between the Joule Effect and the Permeability in the Same Specimens of Steel," S. R. Williams, Oberlin College.

"A Magnetic Test as a Means of Determining Flaws and Mechanical Strains in Iron and Steel," Chas. W. Burrows, Bureau of Standards.

"The Electrical Resistance and the Polarization E.M.F. of a Mixture of Clay, Feldspar and Quartz," A. A. Somerville and O. E. Buckley, Cornell University.

"A Kinetic Theory of Gravitation; Some Explanatory Remarks on my Paper of Last Year," Charles F. Brush, Cleveland.

"Some Diffraction Photographs," Mason E. Hufford, Indiana University.

"Demonstration of Linear and Surface Thermopiles of Bismuth and Silver," W. W. Coblentz, Bureau of Standards.

"The Vertical Temperature Gradient of the Atmosphere," Wm. R. Blair, Mount Weather Observatory, Bluemont, Va.

"A Modified View of Electronic Conduction," Walter P. White, Geophysical Laboratory.

"The Application of Statistical Principles to Photoelectric Effects and Some Allied Phenomena," O. W. Richardson, Princeton University. (By title.)

"The Velocity-distribution Curves of Electrons Liberated by Different Sources of Ultra-violet Light, and the Bearing of these Curves on the Planck-Einstein Theory," R. A. Millikan, University of Chicago.

"A Study of Crystal Rectifiers," R. H. Goddard, Clark University.

"The Half-value of the Radioactive Deposit Collected in the Open Air," F. A. Harvey, Syracuse University.

"Distribution of Current in Point-Plane Discharge," Robt. F. Earhart, Ohio State University.

"The Influence of Temperature on the Phenomena of Phosphorescence in Zinc Sulphide," H. E. Ives and M. Luckiesh.

"On the Free Vibrations of a Lecher System using a Lecher Oscillator, II.," F. C. Blake, Ohio State University. (Read by title.)

"The Thomson Effect in, and the Thermal Conductivity of Tungsten, Tantalum and Carbon at Glowing Temperatures," A. G. Worthing, National Electric Lamp Association, Cleveland.

"The Effect of the Electrical Discharge on Solids and Liquids Suspended in Air," W. W. Strong, University of Pittsburgh.

"A Quantitative Measure of Development in Scientific Observation," Otto Stuhlmann, Jr., Stevens Institute of Technology, Hoboken, N. J.

"Elastic Hysteresis in Metal Bars," A. G. Webster and T. L. Porter, Clark University.

"The Spectra of Iron and Titanium at Moderate Pressure," H. G. Gale, Chicago University.

"The Spark Spectra of the Alkaline Earths in the Schumann Region," Theodore Lyman, Jefferson Physical Laboratory, Harvard University.

"Demonstration of the Resonance Spectrum of Iodine in Vacuo and in Helium," R. W. Wood, Johns Hopkins University.

"A Convenient Device for Obtaining a Steady High Potential for Electrometer Work," A. H. Forman, Cornell University. Introduced by J. S. Shearer.

"The Form of CO_2, SO_2 and NH_3 Crystals," H. E. Behnken. (Introduced by J. S. Shearer.)

"A New Method of Photographing Sound Waves," A. L. Foley and W. H. Souder, Indiana University.

"Another Instrument for Photographing Sound," A. G. Webster, Clark University.

"The Influence of the Natural Periods of Concentrating Horn and Diaphragm upon Sound Wave Records, and the Quantitative Analyses of Tones from Several Musical Instruments," D. C. Miller, Case School of Applied Sciences.

"Slit Width Corrections in the Photometry of Black Body Spectra," E. P. Hyde, National Electric Lamp Association, Cleveland.

"The Effect of Temperature on the Absorbed Charge in Electric Condensers," Anthony Zeleny, University of Minnesota.

"The Influence of Neighboring Conductors upon

a Klemencic Receiver of Electric Waves,'' A. D. Cole, Ohio State University.

''The Absorption of Beta Rays by Gases,'' A. F. Kovarik, University of Minnesota. (Read by title.)

''The Absorption of Gamma Rays of Radium by Air at Different Pressures,'' H. A. Erikson, University of Minnesota.

''Poynting's Tangential Method for showing the Existence of Radiation Pressure an Assumption unwarranted by Experiment,'' R. A. Wetzel, College of the City of New York.

''A New Type of Curve Drawing Instrument and Controller Mechanism,'' M. E. Leeds, Philadelphia, Pa.

''The Silver Voltameter as a Precision Instrument,'' E. B. Rosa, Bureau of Standards.

''Recent Work with the Silver Voltameter,'' G. W. Vinal, Bureau of Standards.

''The Dielectric Constant, Specific Resistance and Electrostatic Absorption of Crystals,'' H. L. Curtis, Bureau of Standards.

''A New Type of Apparatus for Measuring Linear Expansion,'' Arthur W. Gray, Bureau of Standards.

''Temperature Influence upon the Refraction of Quartz, Boro-silicate Crown Glass, and Dense Flint Glass, from 100° C. to — 190° C.,'' F. A. Molby, Cornell University.

''Thermo E.M.F. of the Nernst Filament,'' J. S. Shearer, Cornell University.

''Diffraction Gratings with Controlled Groove and Anomalous Distribution of Intensity'' (illustrated with experiments), R. W. Wood, Johns Hopkins University.

''Further Investigations with the Radiant Emission from the Electric Spark,'' R. W. Wood, Johns Hopkins University.

''A New Type of Neutral Double Potentiometer,'' Walter P. White, Geophysical Laboratory.

''Note on the Ascensional Rate of the Free Balloons used for Meteorological Purposes,'' Wm. R. Blair, Mount Weather Observatory, Bluemont, Va.

''A Modified View of the Electron Theory of Thermoelectricity,'' Walter P. White, Geophysical Laboratory.

''A Simple Dynamical Example of the Genesis of an Integral Equation,'' A. G. Webster, Clark University.

''A New Way to Determine g,'' A. G. Webster, Clark University.

''On the Effect of Close Electrostatic Coupling on the Free Period of a Lecher System,'' F. C. Blake, Ohio State University. (Read by title.)

''Poynting's Theorem and the Equation of Electromagnetic Action,'' W. S. Franklin, Lehigh University.

''A Simple Slit for the Spectroscope,'' J. P. Naylor, DePauw University.

''The Applicability of the Planck Equation to the Radiation from Tantalum and Tungsten,'' E. P. Hyde, National Electric Lamp Association, Cleveland.

''Evidence that the Velocity of Light is Independent of the Motion of the Source,'' D. F. Comstock, Massachusetts Institute of Technology.

''The Specific Heat of Wood,'' Frederick Dunlap, Department of Agriculture, Washington.

''On the Relation between Pressure Displacement and Wave-length,'' W. S. Adams and H. G. Gale, University of Chicago.

''The Expansion of Water below 0° C.,'' J. F. Mohler, Dickinson College.

''The Transmission of the Active Deposit of Radium in an Electric Field,'' E. M. Wellisch, Yale University.

''A New Form of Vacuum Pump,'' J. Johnston, Geophysical Laboratory.

''The Emission of Light by Hydrogen Canal Rays,'' G. S. Fulcher, University of Wisconsin.

''A Sensitive Vacuum Thermal Couple and Method for Producing High Vacua,'' A. H. Pfund, Johns Hopkins University.

''On Magnetic Rays,'' L. T. More and E. G. Rieman, University of Cincinnati. (Read by title.)

''The Wave-Lengths of Neon,'' I. G. Priest, Bureau of Standards.

''The Electric Discharge from Pointed Conductors,'' John Zeleny, University of Minnesota.

''Ellipticity and Rotation in Optically Active Solutions,'' L. B. Olmstead, Bureau of Standards.

''The Language of Meteorology,'' C. F. Talman, Washington.

''The Joule Thomson Effect in CO_2,'' E. S. Burnett, Cornell University.

''On the Theory of the Hysteresis Loop of Iron,'' J. Kunz, University of Illinois.

''The Photo-electric Effect in Phosphorescent Materials,'' G. A. Butman, Yale University.

''An Absolute Determination of the Coefficient of Viscosity of Air,'' L. Gilchrist, Univ. of Toronto.

Alfred D. Cole,
Secretary of Section B,
A. A. A. S.

Ohio State University